REMARKS

Claims 1-22 remain pending in the application, wherein claims 1, 4-6, 13-16, 21 and 22 have been amended. No claims were added or cancelled by this amendment. Reconsideration and allowance of the above-identified application are now respectfully requested.

In a sludge pond, there are multiple layers, including a concentrated sludge layer at the bottom of the pond that forms through gravitational settling and a dilute layer above the sludge layer containing a much higher concentration of liquid (*e.g.*, water) than the sludge layer. The material in the sludge layer is only slightly denser than the adjacent dilute layer and is therefore easily mixed with the adjacent dilute layer unless special care is taken to only gently break up the sludge layer. Moreover, sludge from a sludge pond is a soft, semi-solid mass that can itself be pumped through a conduit. It is not necessary to capture a substantial quantity of water to pump sludge from a sludge layer, as is typically the case when dredging sand, sediment or other solid particles found at the bottom of a body of water. Nor is it desirable since it creates a less concentrated sludge material.

Because sand, sediment and other solid inorganic particles typically found at the bottom of bodies of water have a density that is much greater than water (*e.g.*, >2.5 g/cc compared to 1 g/cc), it is typically necessary for typical dredging apparatus to pump a mixture of particles and substantial water. Sufficient water must be present to suspend the heavier particles so as to form a fluid that can be pumped and carried through a conduit. Mixtures which contain insufficient water to form a pumpable fluid can clog the pump and associated conduit(s).

In contrast, not only is it not necessary to mix together a sludge layer and liquid (*e.g.*, water) to yield a material that is pumpable, it may be undesirable to mix the sludge layer with a substantial amount of liquid from the adjacent dilute layer. To do so yields a mixture from which the added liquid must be removed to yield a more concentrated sludge product. It would therefore be an advancement in the art to provide a sludge harvester designed to gently break up the sludge layer in a manner so as to prevent substantial mixing of the sludge layer and adjacent dilute layer. Moreover, it would be an advancement in the art to capture (*e.g.*, pump) the broken up sludge layer in a manner that avoids the simultaneous capture of a substantial quantity of liquid from the adjacent dilute layer. In this way, a more concentrated sludge material can be captured as compared to conventional dredging apparatus designed to capture sand, sediment and other particles, which typically require the simultaneous capture of a substantial quantity of liquid (*e.g.*, water) in order for the captured particles to be pumpable.

The claims as now presented define a sludge harvester that is specifically designed to gently break up and capture material from a sludge layer adjacent to a dilute layer without causing substantial mixing of the two layers and without capturing a substantial amount of liquid together with the sludge material. As discussed in the application,

> The means for gently breaking up at least a portion of the sludge layer may comprise any mechanical device capable of gently breaking up a portion of the sludge layer. According to one embodiment, the means for gently breaking up at least a portion of the sludge layer comprises a pin mixer, an auger, or a rake. The means for gently breaking up a portion of the sludge layer is intended to just break up the surface of the sludge layer without overly agitating the material of the sludge layer with the adjacent liquid dilute layer. By keeping agitation to a minimum, the nutrient value of the recovered product is maintained at a high level.

Application, ¶ [0014] (emphasis added). The application further teaches

> According to one embodiment, the means for capturing at least a portion of the broken up sludge layer may comprise a pump (*e.g.*, a positive displacement pump). Because the sludge layer is gently broken up and over agitation is undesirable, the pump preferably removes the sludge at a reduced rate as compared to alternative devices and techniques. According to one embodiment, the pump retrieves about 100 gallons per minute (gpm). For comparison sake, traditional dredging devices operate at about 800 gpm, resulting in greatly increased agitation. The increased agitation results in retrieval of a lower concentration of nutrients. In general, the pump will preferably retrieve about 200 gpm or less, more preferably about 150 gpm or less, and most preferably about 100 gpm or less.

Application, ¶ [0015] (emphasis added). The foregoing descriptions provide support for the claims as now amended. Further support is found at paragraphs [0027] and [0028] of the Application.

The invention as claimed combines (i) gently breaking up the sludge layer without overly agitating the material of the sludge layer with the adjacent liquid dilute layer with (ii) capturing the broken up sludge layer using an apparatus that greatly reduces agitation of the sludge and dilute layers. The result is a captured sludge material that has a significantly higher concentration of nutrients than would be possible if the sludge material were mixed with a substantial quantity of liquid from the adjacent dilute layer. Application, ¶ [0027] ("By keeping agitation and mixing to a minimum, the nutrient value recovered is maintained at a high level").

None of the cited references, alone or in combination, teach or suggest a sludge harvester having the combination of features recited in the amended claims. US 6,306,309 to Ekenback et al. discloses a "method for cleaning sand in a sand bed". The pump 7 and associated nozzle 8 are designed to extract "sand, sludge and water" from the bed and discharge this mixture to a hydroclone 13, which separates the sand from the sludge. Col. 3, ll. 8-10. The sand is returned to the bed, and the "water-suspended sludge" is then discharged through pipe 16 and hose 17. Col. 3, ll. 11-14. Ekenback et al. fails to teach or suggest a sludge harvester equipped with "means for gently breaking up at least a portion of a sludge layer adjacent to an aqueous dilute layer without causing substantial mixing of the sludge layer and the adjacent aqueous dilute layer". Instead, the pump 7 and nozzle 8 are designed and positioned so as to suction a mixture of "sand, sludge and water" from the bottom of a body of water. The support roller 9 is not provided to "gently" break up a sludge layer but merely "rests on the sand bed". Col. 3, l. 2.

US 4,957,622 to Mims discloses an "apparatus for removing sediment from ponds". Because sediment comprises solid particles, it is necessary for the Mims device to pump a mixture of sediment and adjacent water. According to Mims, both water and sediment are suctioned into a hydrostatic chamber. Col. 2, ll. 51-60. "[I]nflow turbulence" within the hydrostatic chamber "form[s] a slurry comprising the bottom sediment and water." Col. 3, ll. 11-13. The slurry of sediment and water contains sufficient water as to be capable of being pumped from the hydrostatic chamber to a remote location. Col. 7, ll. 49-52. An important aspect of the Mims device is providing "turbulent mixing action". Col. 8, ll. 65-66. "Turbulent mixing action", however, is not desirable when, as in the claimed invention, it is desired to capture mostly broken up sludge without also capturing substantial liquid from an adjacent dilute layer. Thus, Mims likewise fails to teach or suggest a sludge harvester equipped with "means for gently breaking up at least a portion of a sludge layer adjacent to an aqueous dilute layer without causing substantial mixing of the sludge layer and the adjacent aqueous dilute layer".

US 5,545,326 to Petering was combined with Ekenback et al. and Mims for the proposition that it would have been obvious to use a lower volume pump with the dredging equipment of Ekenback et al. and Mims. However, Petering has absolutely nothing to do with dredging a body of water but is solely related to recirculating sludge within a sludge treatment plant. Thus, the pump volume of Petering is irrelevant to the dredging equipment of Ekenback et al. and Mims, which have completely different pumping requirements because they serve a completely different purpose. Absent undue testing, one of skill in the art would not know

whether the pump used in the sludge treatment apparatus of Petering would have any applicability within the dredging apparatus of Ekenback et al. and Mims. A slow flow pump, while capable of capturing sludge, may very well be incapable of capturing sand as in Ekenback et al. or sediment as in Mims. In any event, since Petering does not involve capturing sand or sediment, one of skill in the art would not have combined Petering with Ekenback et al. or Mims.

As discussed above, the problem to be solved is the inability of conventional dredging apparatus to gently break up and capture a sludge layer without causing substantial mixing of sludge with an adjacent dilute layer and without capturing a substantial quantity of liquid from the dilute layer together with the broken up sludge layer. The solution to this problem is to provide (i) means for gently breaking up the sludge layer without causing substantial mixing of the sludge layer and adjacent dilute layer (*e.g.*, a pin mixer, auger or rake), together with (ii) means for capturing the broken up sludge layer without also capturing a substantial amount of liquid from the dilute layer (*e.g.*, a pump that has a pump volume that is less than 800 gpm and that is positioned so as capture mainly sludge and not a substantial amount of liquid from the adjacent dilute layer). Neither Ekenback et al. nor Mims provide a solution to the stated problem.

Ekenback et al. discloses a machine that has a pump 7 and nozzle 8 designed and positioned so as to capture a mixture of sand, sludge and water. The sand must then be separated from the sludge and water using a hydroclone. Mims discloses a machine that provides "turbulent mixing action" in order to capture a slurry of sediment and water. This slurry is then pumped away. Accordingly, neither Ekenback et al. nor Mims teach or suggest the desirability of gently breaking up a sludge layer without causing substantial mixing with an adjacent dilute layer and without capturing a substantial quantity of liquid from the dilute layer together with the broken up sludge layer. They therefore provide no solution to the problem of conventional dredging equipment capturing substantial liquid together with a sludge layer, as described in the application. Petering as well as US 5,262,064 to El-Shall have absolutely nothing at all to do with gently breaking up a sludge layer and capturing the broken up sludge layer and therefore provide no solution to the problem described in the application. Accordingly, the combined teachings of the cited art neither recognize the problem of conventional dredging equipment capturing substantial liquid together with a sludge layer, nor do they provide a solution to this problem.

Claim 13 is further patentable over Ekenback et al. and Mims because it claims a "non self-propelled sludge harvester" that includes, in combination with the other features, "one or

more skids attached to said frame that support said frame when the sludge harvester is pulled through a sludge pond". A non self-propelled harvester that includes skids that support the frame is shown in Figures 2A and 2B and described generally at paragraph [0030] of the Application. Because the harvester is non self-propelled, the harvester further includes "at least one of a tow rope, a chain, or a cable for pulling the non self-propelled sludge harvester through a sludge pond during use" (see original claim 12). The dredging device of Ekenback et al. is self-propelled and, hence, requires no additional apparatus to pull them through a pond. Ekenback et al. is built like a tank, with tracks looped around wheels. It is therefore highly unlikely that the Ekenback et al. would ever become stuck and require a tow line. The Mims device also sits on wheels. Neither Ekenback et al. nor Mims teach or suggest a harvester that sits upon one or more skids as recited in claim 13.

Claims 21 and 22 are further patentable over Ekenback et al. and Mims because they specifically require a "pump designed so as to pump a volume of about 200 gallons per minute or less during use and positioned so as to capture at least a portion of a broken up sludge layer without also capturing a substantial portion of liquid from the adjacent dilute layer". As discussed in the application, an important difference between a harvester equipped with a lower volume pump and a typical dredging pump is the ability of the former to capture a higher concentrated sludge compared to the latter. Application, ¶¶ [0015] and [0028]. Hence, pumps used in conventional dredging equipment are not obviously substitutable with lower volume pumps. Providing a lower volume pump as recited in claims 21 and 22 provides the ability to capture broken up sludge material "without also capturing a substantial portion of liquid from the adjacent dilute layer". Neither Ekenback et al., Mims nor Petering understand the delicate relationship between pump volume and the ability to capture a more concentrated sludge material. Accordingly, claims 21 and 22 are further patentable for this additional reason.

In view of the foregoing, Applicants submit that the claims as now presented are in allowable form. In the event the Examiner finds any remaining impediment to the prompt allowance of this application, which may be clarified through a telephone interview or that may

be overcome by examiner amendment, the Examiner is requested to contact the undersigned attorney.

Dated this 26th day of April 2006.

Respectfully submitted,

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